for maximizing battery life may also be employed. For example, the maximum pressure and current may be reduced in order to extend the run-time of a battery-powered apparatus of the invention.

It is also contemplated that the pressure control **230** could be a separate control from the actuator **212**. For example, a hydraulic system may be used to determine and monitor the pressure of the brush **208** on the floor **210** independent of the position of the actuator **212**.

It is also contemplated that any of the above described embodiments may include displays indicating actual pressure, torque (or current) and/or position to assist the operator in setting or adjusting the controls. For example, a 10-segment bar graph may be positioned adjacent the head position control **228** to indicate motor current. This would also permit the operator to repeat the same cleaning parameters. Alternatively, the systems of the invention may include a memory **222** for storing various operator settings so that the operator could program the memory **222** and recall the parameter settings as needed.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above products without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

a support;

a connector assembly interconnecting the head assembly and the support;

an actuator on the vehicle for raising and lowering the support relative to the surface;

a sensor detecting a distance between the support and the head assembly;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the support; and

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the support so that the distance between the support and the head assembly as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly.

2. The apparatus of claim **1** wherein the sensor comprises a linear potentiometer.

3. The apparatus of claim **2** wherein the head position control is a operator-controlled potentiometer and further comprising a comparator for comparing a voltage signal generated by the operator-controlled potentiometer to a voltage signal generated by the linear potentiometer, said comparator providing an output signal corresponding to the comparison to the driving circuit.

4. The apparatus of claim **1** further comprising an up/down switch responsive to the operator and connected to the driving circuit for selectively controlling the actuator such that when the switch is in an UP position, the actuator is energized to raise the support and such that when the switch is in a DOWN position, the actuator is energized to lower the support.

5. The apparatus of claim **1** wherein the connector assembly has a first end engaging the head assembly and having a second end engaging the support wherein a distance between the first end and the second end is variable.

6. The apparatus of claim **5** wherein the support is a traveling nut, wherein the actuator comprises a motor rotating a screw which engages and drives the traveling nut, said nut being raised and lowered by rotation of the screw, and wherein the connector assembly comprises:

a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the traveling nut, the tube supporting the head assembly at its other end; and

a compressible member within the tube having one end engaging the nut and having another end engaging the tube; and

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

7. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface; and

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface independent of the brush length or stiffness and thereby controlling the treatment of the surface by the head assembly.

8. The apparatus of claim **7** further comprising a vehicle having pneumatic tires for riding on the surface, said vehicle supporting the actuator such that the head assembly is above or on the surface.

9. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface;

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator

to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

a support connected to the actuator and being raised and lowered by the actuator; and

a connector assembly including a compressible member between the support and the head assembly;

wherein the sensor comprises a distance sensor connected between the support and the head assembly for detecting a distance between the support and the head assembly; and

wherein the driving circuit responds to the distance sensor to control the head position of the head assembly relative to the surface to maintain contact between the head assembly and the surface.

10. The apparatus of claim **9** wherein the distance sensor is a linear potentiometer.

11. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface;

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

a support adapted to be raised and lowered by the actuator; and

a compressible member of variable length between the support and the head assembly;

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

12. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface wherein the actuator comprises a motor rotating a screw driving a traveling nut engaging the screw, said nut being raised and lowered by rotation of the screw;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface;

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the traveling nut, the tube supporting the head assembly at its other end; and

a compressible member within the tube having one end engaging the nut and having another end engaging the tube;

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

13. The apparatus of claim **12** further comprising an inner tube coaxial with and slidable within the slotted tube, the inner tube connected to and moving with the support.

14. The apparatus of claim **12** wherein the sensor comprises a switch on the tube for detecting compression of the compressible member wherein the repeatable position corresponds to the position of the device when it engages the surface.

15. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface;

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

wherein the actuator comprises a motor rotating a screw driving a traveling nut engaging the screw, said nut being raised and lowered by rotation of the screw;

wherein the sensor comprises a detector for providing a count corresponding to the position of the head;

wherein the head position control is set by the operator to indicate the additional preset amount; and

a comparator for comparing the count to the additional preset amount, said driving circuit being responsive to comparator to lower the traveling nut below a repeatable position when the count corresponds to a position which is higher than the additional preset amount as indicated by the head position control.

16. The apparatus of claim **15** wherein the detector comprises a magnet adapted to rotate in synchronism with the screw, a Hall sensor detecting rotation of the magnet and providing a pulse, and a counter for counting the pulses of

the Hall sensor, and wherein the comparator compares the count of the counter to the additional preset amount.

17. The apparatus of claim 16 further comprising a switch for detecting when the nut is in the repeatable position and wherein the switch resets the counter and wherein the driving circuit is responsive to the comparator to lower the traveling nut a number of counts corresponding to the additional preset amount.

18. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface; and

a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

wherein the sensor comprises a switch on the actuator for detecting a position of the head assembly.

19. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

an actuator raising and lowering the head assembly relative to the surface;

a position control responsive to operator input for indicating a head position of the device relative to the surface or range of head positions of the device relative to the surface, said head position or said range of head positions indicating a distance or range of distances, respectively, between the device and the surface; and

a controller responsive to the position control for selectively actuating the actuator to maintain the device in the head position or within the range of head positions as indicated by the position control independent of the brush length or stiffness.

20. The apparatus of claim 19 further comprising:

a pressure sensor detecting the pressure of device on the surface;

a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the device on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating the actuator to maintain the pressure of the device on the surface at the desired pressure or within the desired range of pressures.

21. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

an actuator raising and lowering the head assembly relative to the surface;

a position control responsive to operator input for indicating a head position of the device relative to the surface or range of head positions of the device relative to the surface, said head position or said range of head positions indicating a distance or range of distances, respectively, between the device and the surface;

a controller responsive to the position control for selectively actuating the actuator to maintain the device in the head position or within the range of head positions as indicated by the position control;

a motor on the head assembly for rotating the device;

a torque control circuit having an input receiving a signal for controlling the torque of the motor; and

a torque control responsive to operator input for indicating a desired torque or a desired range of torques for the motor;

wherein the controller is responsive to the torque control for providing a torque control signal to the input of the torque control circuit to maintain the motor at the desired torque or within the desired range of torques.

22. The apparatus of claim 21 further comprising:

a pressure sensor detecting the pressure of device on the surface;

a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the device on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating the actuator to maintain the pressure of the device on the surface at the desired pressure or within the desired range of pressures.

23. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

an actuator raising and lowering the head assembly relative to the surface;

a position control responsive to operator input for indicating a repeatable head position of the device relative to the surface or a repeatable range of head positions of the device relative to the surface, said repeatable head position or said repeatable range of head positions indicating a distance or range of distances, respectively, between the device and the surface; and

a controller responsive to the position control for selectively actuating the actuator to maintain the device in the reapeatable head position or within the reapeatable range of head positions as indicated by the position control independent of the brush length or stiffness.

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